

Section II (Remarks)

A. Summary of Amendment to the Claims

By the present Amendment, claims 1, 2, 38, and 43 have been amended; claims 44 and 45 have been cancelled; and new claim 47 has been added. No new matter within the meaning of 35 U.S.C. §132(a) has been introduced by the foregoing amendments.

The amendments made herein are fully consistent with and supported by the originally-filed disclosure of this application.

B. Subject Matter Indicated to be Allowable

In the October 9, 2007 Office Action, claims 22-24 and 40 were objected to as depending from a rejected base claims, but were indicated to be allowable if rewritten independent form including all of the limitations of the base claim and any intervening claims. Office Action, page 11. No amendments to claims 22-24 and 40 are made herewith, in view of the patentable character of the claims from which they depend.

C. Response to Claim Rejections Under 35 U.S.C. 102

The October 9, 2007 Office Action contained several claim rejections under 35 U.S.C. 102, including:

- a rejection of claims 1-21, 25-39, and 41-46 under 35 U.S.C. 102(e) as being anticipated by U.S. Patent No. 7,228,724 to Chen;
- a rejection of claims 33-35, 38-39, 41, and 42 under 35 U.S.C. 102(b) as being anticipated by U.S. Patent No. 4,415,877 to Takami et al. (“Takami”); and
- a rejection of claim 43 under 35 U.S.C. 102(b) as being anticipated by U.S. Patent No. 2,194,520 to Darrah (“Darrah”).

Such rejections are traversed for the reasons provided below.

I. Law Regarding Anticipation

“Anticipation requires the disclosure in a single prior art reference of each element of the claim under consideration.” *W.L. Gore & Assocs. v. Garlock*, 721 F.2d 1540, 220 USPQ 303 at 313 (Fed. Cir. 1983), *cert. denied*, 469 U.S. 851 (1984). It is not enough that the prior art reference

disclose all the claimed elements in isolation. Rather, “**anticipation requires the presence in a single prior art reference disclosure of each and every element of the claimed invention, arranged as in the claim.**” *Lindemann Maschinenfabrik GmbH v. American Hoist & Derrick Co.*, 730 F.2d 1452, 221 USPQ 481, 485 (Fed. Cir. 1984) (emphasis added). Further, “[u]nder 35 U.S.C. § 102, anticipation requires that ... **the prior art reference must be enabling**, thus placing the allegedly disclosed matter in the possession of the public.” *Akzo, N.V. v. United States Int’l Trade Comm’n*, 808 F.2d 1471, 1 USPQ2d 1241, 1245 (Fed. Cir. 1986) (emphasis added).

2. Traversal of Claim Rejections Under 35 U.S.C. 102(e) Based on Chen

In the October 9, 2007 Office Action at page 2 thereof, following the rejection of claims 1-21, 25-39, and 41-46 under 35 U.S.C. 102(e) as being anticipated by U.S. Patent No. 7,228,724 to Chen, the examiner stated:

The applied reference has a common inventor with the instant application. Based upon the earlier effective U.S. filing date of the reference, it constitutes prior art under 35 U.S.C. 102(e). This rejection under 35 U.S.C. 102(e) might be overcome ... by a showing under 37 CFR 1.132 that any invention disclosed but not claimed in the reference was derived from the inventor of this application and is thus not the invention “by another”

Consistent with the foregoing comment of the examiner, and with the provisions of MPEP 716.10 (“Attribution”), enclosed herewith is a Declaration of Ing-Shin Chen Under 37 CFR 1.132 attesting to the fact that “the subject matter of at least claims 1-21, 25-39, and 41-16 of U.S. Patent Application No. 10/784,750 was derived from the co-inventors of U.S. Patent Application No. 10/758,825 [now issued as U.S. Patent No. 7,228,724].”

Based on such declaration, any invention disclosed but not claimed in U.S. Patent No. 7,228,724 is not the invention “by another,” and any basis for rejection of claims 1-21, 25-39, and 41-16 under 35 U.S.C. 102(e) premised on Chen has been eliminated. Accordingly, withdrawal of the claim rejections under 35 U.S.C. 102(e) premised on Chen is warranted, and is respectfully requested.

3. Traversal of Claim Rejections Under 35 U.S.C. 102(b) Based on Takami

As indicated previously, in the October 9, 2007 Office Action, claims 33-35, 38-39, 41, and 42 were rejected under 35 U.S.C. 102(b) as being anticipated by Takami. The foregoing claims comprise six independent claims, namely, claims 33, 34, 35, 38, 39, and 43.

Takami discloses a gas sensing element (e.g., for detecting oxygen in an exhaust stream from an internal combustion engine) having a nickel wire core externally coated with a coating consisting substantially of platinum, with addition of between 1 to 10% of a low catalytic metal such as gold, silver, nickel, cobalt, iron, titanium, and copper. Takami states that “the **content of the low catalytic metal is limited to 1 to 10% with respect to that of the platinum metal** because if the content of the low catalytic metal is less than 1%, the [catalytic] effect is considerably low, and **if it exceeds 10%, the electrodes are broken when used for a long time** [due to embrittlement and differential thermal expansion characteristics between the low catalytic metal and the platinum metal].” (Takami, col. 2, lines 18-37.)

Claim 33 of the instant application recites:

33. A gas sensor assembly comprising a gas-sensing filament comprising a coating structure and a core structure, wherein said coating structure comprises nickel or nickel alloy, and wherein said **core structure comprises silicon carbide**.
(Emphasis added.)

Nothing in Takami discloses any core structure comprising silicon carbide. The examiner mistakenly points to “col 2, lines 60-64” of Takami as disclosing a core structure comprising silicon carbide (Office Action, page 10.) In fact, the terms “silicon carbide” or “SiC” are **nowhere** used in Takami. Accordingly, Takami fails to disclose “each and every element of [claim 33], arranged as in the claim” as required to support an anticipation rejection. (*Lindemann, supra.*) In view of the failure of Takami to disclose all elements of claim 33, withdrawal of the rejection of such claim is warranted, and is respectfully requested.

Claim 34 of the instant application recites:

34. A gas sensor assembly comprising a gas-sensing filament comprising a coating structure and a core structure, wherein said coating structure comprises nickel or nickel alloy, and wherein said **core structure comprises a carbon center and a sheath of silicon carbide**.
(Emphasis added.)

As indicated previously, nothing in Takami discloses “silicon carbide” or “SiC.” Moreover, nothing in Takami discloses any filament having a core structure comprising “a carbon center.” Takami does disclose exposure of sensors having platinum- and low-catalytic metal-containing cover layers to carbon-containing gases (see, e.g., Takami, columns 3-4 and Table 1 thereof), but any carbon addition is limited to external deposition. As a result, Takami fails to disclose any sensor filament having a core structure comprising a “carbon center,” let alone such a structure also having a sheath of silicon carbide. Accordingly, Takami fail to disclose “each and every element of [claim 34], arranged as in the claim” as required to support an anticipation rejection. (*Lindemann, supra.*), such that withdrawal of the anticipation rejection of claim 34 is warranted.

Claim 35 of the instant application recites:

35. A gas sensor assembly comprising an **electrochemically-thinned gas-sensing filament** comprising nickel or nickel filament, wherein **said filament is characterized by an average diameter of not more than 50 microns**.
(Emphasis added.)

Nothing in Takami discloses any “electrochemically-thinned gas sensing filament.” The examiner points to col. 1, lines 46-51 of Takami as providing such disclosure, but such passage only discloses “nickel wires” without any indication that such wires are “electrochemically thinned.”

Additionally, nothing in Takami discloses any filament having “an average diameter of not more than 50 microns.” The examiner cites Takami, col. 2, lines 58-68 as disclosing “a cover layer 2b of 50 μ ” (Office Action, pages 10-11), but the examiner has failed to appreciate that such cover layer is applied OVER a nickel wire having a core of 0.35 mm diameter:

“Each electrode 2 was prepared by forming a cover layer 2b of 50 μ in thickness by cladding an alloy containing essentially platinum metal and low catalytic metal, on the surface of a nickel wire 2a of 0.35 mm diameter.”
(Takami, col. 2, lines 60-64.)

To be clear, one micron equals 1×10^{-6} meter, and one millimeter equals 1×10^{-3} meter, such that one micron represents one-thousandth of one millimeter. The 0.35 mm nickel wire core of Takami equals **350 microns**., and the addition of a cover layer 2b of 50 micron thickness raises the overall diameter of Takami’s sensor filament to **450 microns**. As a result, Takami fails to

disclose any filament having “**an average diameter of not more than 50 microns**” as required by claim 35. Takami’s filament diameter is more than nine times the threshold recited in claim 35. Accordingly, Takami fails to disclose “each and every element of [claim 35], arranged as in the claim” as required to support an anticipation rejection. (*Lindemann, supra.*), such that withdrawal of the anticipation rejection of claim 35 is warranted.

Claim 38 of the instant application, as amended herewith, recites:

38. A gas sensor assembly comprising a gas-sensing filament comprising a nickel-copper alloy, **wherein said nickel-copper alloy comprises from about 10% to about 90% of nickel, and from about 10% to about 90% of copper.**

Takami discloses use of between 1% to 10% of a low catalytic metal such as gold, silver, nickel, cobalt, iron, titanium, and copper. Takami further states that “the content of the low catalytic metal is limited to 1 to 10% with respect to that of the platinum metal because if the content of the low catalytic metal is less than 1%, the [catalytic] effect is considerably low, and if it exceeds 10%, the electrodes are broken when used for a long time [due to embrittlement and differential thermal expansion characteristics between the low catalytic metal and the platinum metal].” (Takami, col. 2, lines 18-37.)

Nothing in Takami expressly teaches use of any nickel-copper alloy. In contrast to Takami, amended claim 38 requires at least about 10% nickel AND at least about 10% copper – constituting at least about 20% of such metals in combination. Such 20% *minimum* threshold is double the maximum threshold taught by Takami for all “low catalytic metals” to be added to a sensor. Accordingly, Takami fails to disclose “each and every element of [amended claim 38], arranged as in the claim” as required to support an anticipation rejection. (*Lindemann, supra.*), such that withdrawal of the anticipation rejection of claim 38 is warranted.

Claim 39 of the instant application recites:

39. A gas sensor assembly comprising a gas-sensing filament comprising a **nickel-copper-aluminum alloy**. (Emphasis added.)

In the Office Action, the examiner points to col. 5, lines 11-16 and col. 6, lines 11-14 of Takami as disclosing a **nickel-copper** alloy; however, **Takami fails to teach any alloy containing all**

three of nickel, copper, and aluminum. It is noted that aluminum is readily oxidized in the presence of oxygen (see Exhibit A: “Advanced Structural Materials: Properties, Design Optimization, and Applications” by W. O. Soboyejo, T. S. Srivatsan, eds., CRC Press, 2006, , page 263¹ (ISBN 1574446347)), whereas **Takami specifically teaches that oxidation of a gas sensing element should be prevented** (e.g., through use of platinum and similar materials). Takami, col. 1, lines 24-30).

Because Takami fails to teach any use of aluminum in a gas sensing element as required by claim 39, Takami fails to disclose “each and every element of [claim 39], arranged as in the claim” as required to support an anticipation rejection. (*Lindemann, supra.*). Accordingly, withdrawal of the anticipation rejection of claim 39 is warranted, and is respectfully requested.

Claim 41 of the instant application recites:

41. A gas sensor assembly comprising a nickel-containing gas-sensing filament having a porous surface.

Takami teaches that “gas sensing element **includes a semiconductor made of a sintered oxide** of a metal such as titanium dioxide cobalt, tin or chromium, **and a pair of electrodes embedded in the semiconductor**, as lead wires across the electrical resistance of the semiconductor.” (Takami, col. 1, lines 10-15.) Fabrication of such device is described as follows:

...a **pair of electrodes are embedded in a mass of metal oxide powder**, which is the raw material of the semiconductor. The electrodes and the mass of metal oxide powder are **molded in a die under pressure and are then subjected to sintering** at a temperature of 1200° C. or higher. Therefore, even if sintering is carried out in an inert atmosphere, the electrodes are unavoidably oxidized. Accordingly, the electrodes are made of expensive platinum or a platinum alloy such as platinum-rhodium (hereinafter referred to as “platinum metal”), to prevent oxidation. On the other hand, the **semiconductor made of the sintered oxide (hereinafter referred to as “an oxide semiconductor”) is made porous** to increase the gas sensing ability. Therefore, **CO and HC in the exhaust gas enter the porous semiconductor and come in contact with the platinum metal electrodes** [embedded therein], and carbon is deposited by their catalytic reaction. (Takami, col. 1, lines 19-36)(emphasis added).

¹ “**Aluminum is an active metal that tends to readily oxidize** under the influence of high free energy of the reaction whenever the necessary conditions for oxidation are conducive and/or prevailing.” (Id., pp. 263.)

The foregoing passage of Takami makes clear that metal electrodes are embedded in a sintered metal oxide, wherein the sintered metal oxide (“oxide semiconductor”) is porous. **Nothing in Takami teaches or remotely suggests that any electrode is porous**, however.

In contrast to Takami’s disclosure, claim 41 requires “a nickel-containing gas-sensing **filament having a porous surface**.” The only structure disclosed in Takami corresponding to any filament is Takami’s electrode(s); however, nothing in Takami teaches or remotely suggests any electrode (or filament) having a porous surface. Accordingly, Takami fails to disclose “each and every element of [claim 41], arranged as in the claim” as required to support an anticipation rejection. (*Lindemann, supra.*), such that withdrawal of the anticipation rejection of claim 41 is warranted.

Claim 42, which depends from claim 41, inherently includes all the limitations of claim 41 (pursuant to 35 U.S.C. 112); accordingly, claim 42 is distinguished over Takami for the same reasons as articulated in connection with claim 41 above.

4. Traversal of Claim Rejections Under 35 U.S.C. 102(b) Based on Darrah

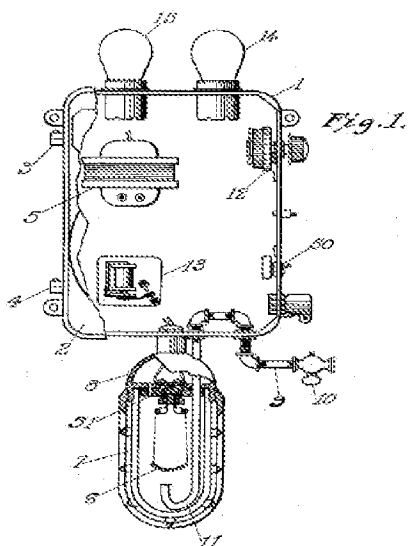
As indicated previously, in the October 9, 2007 Office Action, claim 43 was rejected under 35 U.S.C. 102(b) as being anticipated by Darrah. Claim 43 as amended herewith recites:

43. A gas sensor assembly comprising a support structure for suspending a free-standing nickel-containing gas-sensing filament, wherein **the support structure comprises a material selected from the group consisting of polyimide, aluminum, and nickel.**

In connection with such rejection of claim 43, the examiner stated:

William [*sic* – Darrah] discloses a gas sensor assembly comprising a support structure (supporting frame 1 and filament 6, see col. 1, lines 28-30, 34-36, also col. 2, lines 59-62). (Office Action, page 11.)

Figure 1 of Darrah is reproduced below.



Darrah teaches that “[s]upporting frame 1 carries a transformer 5 arranged to supply current to a filament 6 located in a glass globe 7 carried by a fitting 8 which in turn is supported by frame.” (Darrah, col. 1, lines 28-31.)

Nothing in Darrah discloses any “support structure compris[ing] a fluoro-resistant material selected from the group consisting of polyimide, aluminum, and nickel” as required by amended claim 43. Accordingly, Darrah fails to disclose “each and every element of [amended claim 43], arranged as in the claim” as required to support an anticipation rejection. (*Lindemann, supra.*), such that withdrawal of the anticipation rejection of claim 43 is warranted.

CONCLUSION

Based on the foregoing, all of Applicants' pending claims are patentably distinguished over the art, and in form and condition for allowance. The examiner is requested to favorably consider the foregoing, and to responsively issue a Notice of Allowance. If any issues require further resolution, the examiner is requested to contact the undersigned attorney at (919) 419-9350 to discuss same.

Respectfully submitted,

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Enclosures:

- Exhibit A - Excerpt from "Advanced Structural Materials: Properties, Design Optimization, and Applications" by W. O. Soboyejo, T. S. Srivatsan, eds., CRC Press, 2006, page 263
- Declaration of Ing-Shin Chen Under 37 CFR 1.132

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